

Tribhuvan University
Institute of Science and Technology
2080
☆☆

Bachelor Level / Second Year/ Fourth Semester
Bachelors in Information Technology (ORS255)
(Operations Research)

Full Marks: 60
Pass Marks: 24
Time: 3 hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

Section A

Long Answer Questions

Attempt any TWO questions.

(2 × 10 = 20)

1. Solve the given linear programming problem (LPP) by using simplex method and interpret the findings.

Maximize $Z = 4A + 3B + 6C$

Subject to the constraints:

$$2A + 3B + 2C \leq 440$$

$$4A + 3C \leq 470$$

$$2A + 5B \leq 430,$$

and $A, B, C \geq 0$

2. A project consists of nine activities whose time estimates (in weeks) and other characteristics are given below:

| Activities | A | B | C | D | E | F | G | H | I |
|----------------------|---|---|----|---|----|------|------|------|----|
| Preceding activities | — | — | — | A | A | B, D | B, D | C, F | E |
| Optimistic time | 2 | 6 | 6 | 2 | 11 | 8 | 3 | 9 | 4 |
| Most likely time | 4 | 6 | 12 | 5 | 14 | 10 | 6 | 15 | 10 |
| Pessimistic time | 6 | 6 | 24 | 8 | 23 | 12 | 9 | 27 | 16 |

(a) Show the PERT network diagram for the project.

(b) Identify the critical activities.

(c) What is the expected project completing time and its variance?

3. A milk salesman estimates the probability of the demand for a litre of milk is as follows:

| Demand | 11 | 12 | 13 | 14 | 15 |
|-------------|------|------|------|------|------|
| Probability | 0.10 | 0.15 | 0.30 | 0.25 | 0.20 |

He purchases a litre of milk @ of Rs. 60 and sells it @ of Rs. 70. Assuming that unsold milk has no scrap value, find

- (a) Find optimum quantity that would obtain Max. EMV.
(b) Find the minimum value of EOL.
(c) What is the value of expected profit with perfect information (EPPI)?

Section B

Short Answer Questions

Attempt any EIGHT questions.

(8 × 5 = 40)

4. The ABC company has three jobs to be done on three machines. Each job must be done on one and only one machine. The cost of each job on each machine is given in the following table.

| Jobs | Machine | | |
|------|---------|---|---|
| | X | Y | Z |
| A | 4 | 6 | 8 |
| B | 2 | 3 | 4 |
| C | 4 | 8 | 5 |

By using Hungarian method, find the job assignments which will minimize the cost.

5. Food X contains 6 units of vitamin A and 7 units of vitamin B and costs Rs. 5 per gram. Food Y contains 8 units of vitamin A and 12 units of vitamin B and costs Rs. 18 per gram. The daily minimum requirement of vitamins A and B are respectively 100 units and 138 units respectively. Formulate the problem as a LPP with the objective function minimizing the cost.
6. Customers arrive at a bank having single counter at the rate of 25 customers per hour. Time required to serve a customer has exponential distribution and average number of customer served per hour is 30. Find the average number of customers in queue and in system as well.
7. Find the initial solution by using Vogel's Approximation Method (VAM).

| From \ To | P | Q | R | S | Supply |
|-----------|----|----|----|----|--------|
| A | 19 | 30 | 50 | 10 | 7 |
| B | 70 | 30 | 40 | 60 | 9 |
| C | 40 | 8 | 70 | 20 | 18 |
| Demand | 5 | 8 | 7 | 14 | 34 |

8. The following is the payoff matrix of a game being played by A and B. Determine the optimal strategies for the players and the value of the game.

| A's strategies | B's strategies | | |
|----------------|----------------|----------------|----------------|
| | B ₁ | B ₂ | B ₃ |
| A ₁ | 120 | -80 | -20 |
| A ₂ | 60 | 70 | 30 |
| A ₃ | -100 | 70 | 20 |

9. Draw the network diagram and identify critical path and bottleneck activities.

| Activity | A | B | C | D | E | F | G |
|----------------|---|---|---|---|-----|-----|-----|
| Predecessors | - | A | A | A | B,C | C,D | E,F |
| Time (in days) | 7 | 4 | 5 | 6 | 7 | 5 | 6 |

10. Describe dominance rule method for solving a problem of game theory.
11. Describe different types of queuing disciplines used in serving a customer in a queue.
12. Write short notes on:
- Marginal analysis approach in decision making.
 - Modified distribution (MODI) method.